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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/710,391	07/07/2004	Gopal B. Avinash	153643XZ (GEMS0250PUS)	4390

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EXAMINER	
BLOOM, NATHAN J	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/710,391	AVINASH ET AL.	
	Examiner	Art Unit	
	Nathan Bloom	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 July 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21 and 26-31* is/are rejected.

7)☒ Claim(s) *22-25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 July 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because the label for item 104 of Figure 4 requires a spelling correction "Smooth the Normalized Raw Image Date" should read "Smooth the Normalized Raw Image Data". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-21 and 26-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Avinash (US 6208763).

Instant claim 1: A method of adaptively reducing noise within an x-ray image comprising:

receiving raw data from an x-ray detector representing a detected x-ray signal from an object; [See *line 18 column 3 to line 13 column 4 and Figure 1.*]

generating a counts-based modulation mask in response to said raw data; [*Line 66 of column 8 to line 34 of column 10 wherein a mask is created based on counts and gradient orientation.*]

generating a structure dependent noise filtered image in response to said raw data; and [*Step 66 of figure 3 and line 56 of column 4 to line 65 of column 6.*]

generating a noise reduced image in response to said counts-based modulation mask and said structure dependent noise filtered image. [*Utilizing the structure, counts, and connectivity the image is filtered in steps 70 and 72 of figure 3. These filtering steps are explains in columns 10-12.*]

Instant claim 2: A method as in claim 1 further comprising:

generating a structure gradient mask in response to said raw data; and [*Lines 56 of column 4 to line 65 of column 6 is the creation of the gradient image and the thresholding of it to create the structure gradient mask.*]

generating said noise reduced image in response to said structure gradient mask. [*Noise reduced image is calculated from structure gradient mask through filtering of structure/non-structure regions. For further explanation of filtering steps see columns 8-12.*]

Instant claim 3: A method as in claim 1 further comprising:

normalizing said raw data in response to a dose-sensitivity setting of said x-ray detector; and [*Figure 3 object 64 and lines 40-55 of column 4.*]

generating said noise reduced image in response to said normalization. [*As can be seen in Figure 3 this step is one of the first steps in the process of creating a reduced noise image.*]

Instant claim 4: A method of adaptively reducing noise within an x-ray image having a plurality of pixels comprising:

receiving raw data representing a detected x-ray signal from an object; [*See rejection of instant claim 1.*]

generating a counts-based modulation mask in response to said raw data; [*See rejection of instant claim 1.*]

generating a structure gradient mask in response to said raw data; and [*See rejection of instant claim 1.*]

generating a noise reduced image in response to said counts-based modulation mask and said structure gradient mask. [*See rejection of instant claim 1.*]

Instant claim 5: A method as in claim 4 further comprising:

executing a structural analysis of said raw data to derive a structure dependent noise filtered image; and [*See line 30 of column 5 to line 65 of column 6 wherein structural analysis is done by creating a gradient image and thresholding this image.*]

generating said noise reduced image in response to said structure dependent noise filtered image. [*Noise reduced image is end result of the process wherein the structure is identified and then further refined before filtering (noise reduction) is performed. See columns 8-12 for filtering details.*]

Instant claim 6: A method as in claim 4 wherein said structure gradient mask is generated in response to execution of a structural analysis of said raw data. [*See line 30 of column 5 to line 65 of column 6 wherein structural analysis is done by creating a gradient image and thresholding this image.*]

Instant claim 7: A method as in claim 4 wherein generating said noise reduced image comprises: generating a conditioned structure mask in response to said raw data; and [*See line 66 of column 6 to line 65 of column 8 wherein further masking is performed to analyze the connectivity of pixels and thus improve (condition/refine) the structure mask.*]
blending said counts-based modulation mask and said conditioned structure mask to generate a blended image having a plurality of blended values. [*In lines 1-19 of column 9 the mask is refined (blended) based on the creation of new binary mask that is created based on a count of the pixel of interest. A plurality of values (0 or 1) are generated for the mask and then based on this mask the values of the mask Ms (structure intensity) are blended with the (plurality) values of alpha and beta.*]

Instant claim 8: A method as in claim 7 wherein blending comprises modulating said blending values at each pixel location of said plurality of pixels in response to said counts-based modulation mask [*Binary count based masking.*] and said conditioned structure mask [*Gradient Threshold Mask*]. [*See rejection of instant claim 7. Furthermore, filtering based on multipliers alpha and beta involves changing (modulating) the values within the kernel.*]

Instant claim 9: A method as in claim 4 further comprising:

executing a structural analysis of said raw data to derive a structure dependent noise filtered image and to generate a conditioned structure mask; [*See rejection of claims 5 and 7.*]

blending said raw data, said counts-based modulation mask, said structure dependent noise filtered image, and said conditioned structure mask to generate a blended image [*See rejection of claim 5 wherein refinement (blending) of conditioned structure mask and count based mask is performed and rejection of claim 7 where refinement/conditioning of structured mask is performed thus creating the conditioned mask. In line 64 of column 11 to line 43 of column 12 the raw image data is blended with the masked image data.*]; and

generating said noise reduced image in response to said blended image. [*End product of blending and filtering the masks and image.*]

Instant claim 10: A method as in claim 9 wherein said blended image is generated in response to a final mask defined as the multiplication of said counts-based modulation mask and said conditioned structure mask. [*Final mask is the mask that is created after the filtering based on alpha beta and the counts-based modulation mask described in the rejection of instant claim 7.*]

Instant claim 11: A method as in claim 10 wherein said blended image is generated in response to the multiplication of said structure dependent noise filtered image, said final mask, and a predetermined blend parameter. [*See column 12 lines 10-43 and Fig 15 for blending step where in the blend parameters "1-a", 1-b" and T are used.*]

Instant claim 12: A method as in claim 10 wherein said blended image is generated in response to the multiplication of said raw data by a subtracted result of one minus a multiplied result of a predetermined blend parameter and said final mask. [*See rejection of claim 11 wherein "a" and "b" are blend parameters.*]

Instant claim 13: A method as in claim 4 further comprising:

generating a conditioned structure mask in response to said structure gradient mask; and [*See rejection of instant claim 7.*]

generating said noise reduced image in response to said conditioned structure mask. [*End product of the masking and filtering process.*]

Instant claim 14: A method as in claim 13 wherein said conditioned structure mask is generated in response to a low count modulation of said raw data and a weighted function. [*Column 6 line 66 to column 7 line 45 discusses a connectivity analysis which removes groups of connected pixels have populations lower than a threshold (low count modulation) thus refining (conditioning) the structure mask by removing noisy segments.*]

Instant claim 15: A method as in claim 13 wherein generating said conditioned structure mask comprises:

generating a gradient threshold value; [*See column 7 line 65 to column 8 line 17 wherein using the histogram the threshold is generated.*]

generating a gradient threshold scaler; [*The threshold is scaled proportionally to the desired number of structure pixels (see same section as noted above).*]

generating a weighted function in response to said structure gradient mask, said gradient threshold value, and said gradient threshold scaler; and [*The weights one and zero are applied based on if the pixel values are greater/less than the threshold value. See lines 27-65 of column 8.*]

generating said conditioned structure mask in response to said raw data and said weighted function. [*As per rejection above, mask of 1's and 0's is created. Lines 60-65 of column 8.*]

Instant claim 16: A method as in claim 13 wherein said conditioned structure mask is generated in response to a low count limit and a low count flat. [*See focus parameter (low count flat, flat or constant value added in addition to desired population count of structural pixels) and the counted population (pixels counted in step 94 of Fig.4, or low count limit). See line 65 column 7 to line 17 of column 8 wherein the two parameters are used to generate the threshold and thus the conditioned structure mask.*]

Instant claim 17: A method as in claim 4 wherein said counts-based modulation mask represents a weighting function on absolute detected intensities comprising effects of imaging system gain. [*Pixel values are detected intensities comprised of the effects of imaging system gain and thus the mask weighting function described in the rejection of instant claim 15 depends on "absolute detect intensities……".*]

Instant claim 18: A method as in claim 4 wherein generating said noise reduced image comprises:

generating a plurality of blended values in response to said counts-based modulation mask and said structure gradient mask; and [*Values blended as per rejection of instant claim 7.*]

intensity matching said plurality of blended values. [*After values are blended, in lines 45-60 of column 10 intensity matching is performed wherein if variance exceeds a certain amount then the pixel intensity is set equal to the average value of pixels in the kernel.*]

Instant claim 19: A method as in claim 18 wherein intensity matching said plurality of blended values comprises equalizing intensity levels of said blended image. [*Intensity matching as described in rejection of instant claim 18 is the process of equalizing intensity levels.*]

Instant claim 20: A method as in claim 4 wherein generating a counts-based modulation mask comprises assigning each pixel location of the plurality of pixels a weight in response to a detected signal level at that location. [*A weight of 0, 1, or a value corresponding to the function s assigned as per column 9 line 59 to column 10 lines 13.*]

Instant claim 21: A method as in claim 20 wherein said weight is assigned in response to a count modulation curve. [*Weight is assigned based on function/curve in line 5 of column 10.*]

Instant claim 26: A method as in claim 4 wherein generating said noise reduced image comprises:

generating blended values in response to said counts-based modulation mask and said structure gradient mask; and [*See rejection of claim 7.*]

generating said noise reduced image in response to said blended values, smoothing of said raw data, and smoothing of said blended values. [*See rejection of claim 9.*]

Instant claim 27-31: Claims 27-31 described the system that performs the method of claims 1-21. [*Method has been described as per rejection of instant claims 1-21. Furthermore, hardware components are described in line 18 of column 3 to line 2 of column 4.*]

Allowable Subject Matter

4. Claims 22-25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 22-25 contain further limitations such as "a group of count modulation curves", "low/medium/high noise reduction curves", "Gaussian distribution", and other limitations further defining the count modulation curves. These limitations were not taught in the known prior art.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Turek (US 6757414) – (35 USC 102(a) date) creates a classification map based on pixel intensity (count modulation mask).
- Avinash (US 6757442) – (35 USC 102(a) date) similar disclosure to patent used in rejection above.
- Sutton (US 5978505) – (35 USC 102(b) date) normalization of image, pixel counting based on pixel modulation, adjustment of intensity, weighting of values, uses neural network and clustering.
- Nelson (US 5787201) – (35 USC 102(b) date) intensity and pixel count thresholding.
- Eck (US 6999609) – (PGPUB has 35 USC 102(b) date) regional smoothing (denoising) of segmented image.
- Perino (US 6593961) – (35 USC 102(a) date) classifies pixels into regions based on intensities.
- Simon (US 2003/0223622) – (35 USC 102(e) date) system for enhancing images wherein a mask is blended with raw image data.
- Szeliski (US 6320978) – (35 USC 102(b) date) blending pixels and weighting masked pixels more than unmasked pixels.

- Weiss (US 5740266) – (35 USC 102(b) date) – minimum pixel count change mask.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed, can be reached on 571-272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nathan Bloom